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Oncological and Surgical Outcomes of Oncoplastic Reduction Mammoplasty: A Single-centre Retrospective Study

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Abstract. *Background/Aim: Breast-conserving surgery is the preferred treatment for early-stage breast cancer but can often result in unsatisfactory cosmetic outcomes. Oncoplastic surgery aims to improve both oncologic and aesthetic outcomes by combining local excision with plastic surgery techniques. Using breast reduction techniques in breast cancer treatment has been shown to allow for wider margins of excision, leading to enhanced oncological safety and reduced recurrence rates without causing significant asymmetry. This study aimed to analyze the surgical and oncological outcomes of a large cohort of patients undergoing oncoplastic reduction mammoplasty (ORM). Patients and Methods: A retrospective analysis of postoperative surgical and oncological outcomes of all patients who underwent ORM at a single center between January 2018 and December 2023 was performed. Preoperative patient characteristics, operative and post-operative outcomes were recorded and analyzed. Results: A total of 67 patients that underwent oncologic breast reduction were included in the final analysis – representing a total of 71 ORM, with a mean (SD) age of 53.1 (10.5) years and a mean (SD) BMI of 28.8 (5.9) kg/m^2. A superomedial pedicle-based technique was the most frequently used (36.6%), followed by inferior pedicle-based technique (28.1%). A complication rate of 18.3% on the ipsilateral side was observed. Salvage surgery was necessary in five cases (7.0%) due to positive margins – with one patient (1.4%) requiring margin expansion surgery and four (5.6%) a completion mastectomy. Conclusion: This monocentric retrospective study shows that ORM is safe, with a complication rate on par with conventional breast reduction and offers satisfactory oncological outcomes.*

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Breast-conserving surgery has emerged as a preferred treatment for early-stage breast cancer, offering low recurrence rates and comparable survival rates when compared to mastectomy (1, 2). Despite its advantages, this approach can be technically challenging and result in less-than-optimal cosmetic outcomes, impacting patient satisfaction, sexual well-being, and overall quality of life (3, 4).

To tackle these issues, oncoplastic surgery integrates wide local excision and tissue rearrangement through plastic surgery techniques. Its goal is to enhance both the oncological and aesthetic outcomes of breast-conserving surgery. Current literature shows that oncoplastic surgery achieves similar local recurrence and survival rates compared to traditional breast-conserving surgical approaches while also improving cosmetic results (5-7).

According to the consensus definition by the American Society of Breast Surgeons, oncoplastic surgery is described as breast-conserving surgery that integrates oncologic partial mastectomy with ipsilateral defect repair using volume displacement or replacement techniques and includes surgery to achieve contralateral symmetry when necessary (8). In this context, oncoplastic reduction mammoplasty (ORM) is a method of choice. Beyond tumor removal, this technique incorporates a reduction mammoplasty, and, to ensure symmetry, a reduction of the opposite breast is often performed simultaneously in the same procedure.

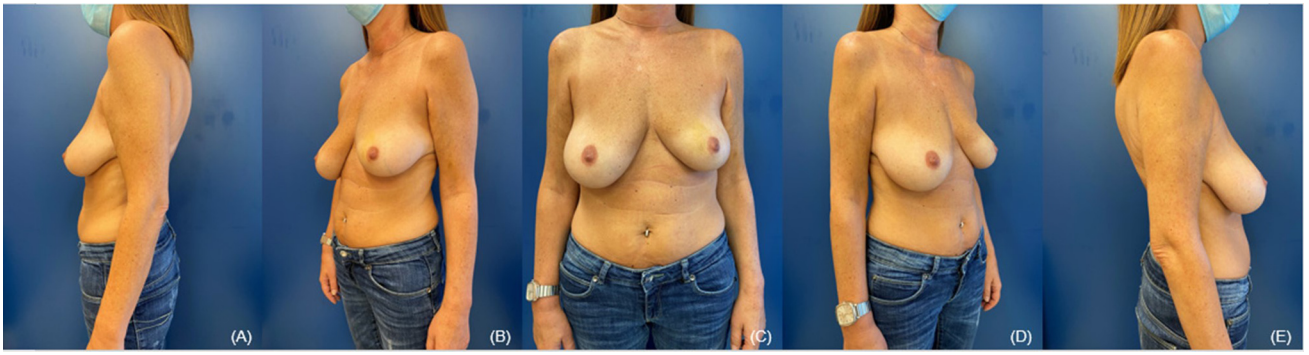

Figure 1. *Preoperative views of a 53-year-old patient presenting with the diagnosis of invasive ductal carcinoma of the upper inner quadrant of the left breast and an important asymmetry in favor of the right breast, lateral (A, E), frontal (C) and semi-lateral (B, D). The indication for oncoplastic reduction mammoplasty on the left breast and immediate symmetrization of the right breast is posed after multidisciplinary tumor board discussion.*

The adoption of reduction mammoplasty in the treatment of breast cancer enhances the ability to achieve wider excision margins, thereby improving oncological effectiveness. Additionally, this surgical strategy serves to avert the occurrence of breast deformity or pronounced asymmetry relative to the unaffected breast. Recently, tree large systematic reviews showed that the technique is an excellent option and is associated with low complication rates (9-11). This study aimed at providing comprehensive analysis of surgical and oncological outcomes of a monocentric cohort of patients who underwent ORM in the context of breast cancer.

Patients and Methods

A retrospective review of consecutive female patients who had an ORM at Geneva University Hospitals from January 2018 to December 2023 was performed. Patients were excluded from the study if another surgical technique for breast reconstruction was used, in case of a prophylactic breast reduction, or an incomplete medical record. Data on patient demographics, comorbidities, oncologic characteristics, oncologic treatment details, surgical procedure details, postoperative outcomes, and length of follow-up were gathered for analysis. Informed consent was obtained from all patients and the study was granted approval by the Geneva ethics committee 'Commission Cantonale d'Ethique de la Recherche sur l'être humain' (project ID: CCER 2023-02244).

A descriptive analysis of data was conducted, with continuous variables presented as mean±standard deviation (SD) and categorical variables presented as absolute values and the proportion as percentage (%). Patient groups were compared using independent two-sided *t*-tests for means and two-sided Chi-square or Fisher's exact tests as appropriate to analyze categorical variables. Statistical analysis was carried out using GraphPad Prism (version 10, GraphPad software, La Jolla, CA, USA).

Surgical technique. Preoperative markings are performed based on a keyhole wise pattern, with the choice of pedicle foreseen based on the location of the tumor (Figure 1, Figure 2). Our team then begins de-epithelialization after marking the areola with the areola marker. At this point, the mastectomy along with the sentinel lymph node search is conducted by the gynecological team, with all patients having had a metallic harpoon marker placed beforehand. Subsequently, our team proceeds with breast reduction, sculpting the pedicle using the remaining breast tissue. In cases of bilateral breast reduction, we employ the same pedicle technique on the contralateral side, aiming for symmetrical resection weights if there is no preoperative breast asymmetry. Symmetry is assessed with the patient in a sitting position before closure.

Figure 2. *Preoperative drawings, based on a keyhole wise pattern. A breast marking harpoon was placed under ultrasound control preoperatively in the left-breast to guide tumor resection.*

Table I. *Baseline characteristics*.

Baseline characteristics	
	n=67
Age (years), mean (SD)	53.1 (10.5)
BMI (kg/m^2), mean (SD)	28.8 (5.9)
Smoker, n (%)	19 (28.4%)
Diabetes, n (%)	6 (9.0%)
ASA score, mean (SD)	2.1 (0.3)
Prior breast surgery	
Lumpectomy, n (%)	
Ipsilateral	1 (1.5%)
Contralateral	3 (4.5%)
Mastectomy, n (%)	
Ipsilateral	0 (0%)
Contralateral	1 (1.5%)
Breast reduction, n (%)	2 (3%)
Tumor characteristics, n (%)	
Unilateral tumor	63 (94.0%)
Bilateral tumor	4 (6.0%)
Location, n (%)	n=71
Upper inner quadrant	9 (12.7%)
Upper outer quadrant	22 (31.0%)
Upper pole	12 (16.9%)
Lower inner quadrant	11 (15.5%)
Lower outer quadrant	8 (11.3%)
Lower pole	6 (8.45%)
Other	3 (4.2%)
Neoadjuvant treatment, n (%)	
Chemotherapy	13 (19.4%)
Immunotherapy	4 (6.0%)
Endocrine therapy	4 (6.0%)

Table II. *Operative characteristics*.

Operative characteristics	
Pedicle type, n (%)	*n=71*
Inferior	20 (28.1%)
Superomedial	26 (36.6%)
Superior	18 (25.4%)
Other	7 (9.9%)
Contralateral symmetrization procedure	56 (88.8%)[§]
Ipsilateral reduction weight [g], mean (SD)	248.5 (236.4)
Contralateral reduction weight [g], mean (SD)	253.5 (224.7)
Sentinel node biopsy	
Positive	14 (19.7%)
Negative	53 (79.1%)
Not assessed	3 (4.2%)
Axillary lymph node dissection	
Performed	14 (19.7%)
Not performed	58 (81.7%)
Operative time, mean (SD)	187.5 (75.7)
Time to radiation therapy start after surgery	

[§]This number excludes four patients with bilateral ORM.

Results

Patient population characteristics. A total of 67 consecutive patients were included, corresponding to 71 ORM. The patients had an average age of 53.1±10.5 years, and a mean BMI of 28.8±5.9 kg/m2. Six (9%) patients had a history of diabetes mellitus, and 19 patients (28.3%) were active smokers. The average ASA (American Society of Anesthesiology) score was 2.1±0.3. Seven (10.4%) patients had a history of prior breast surgery – with two (3%) having had a prior breast reduction, one (1.5%) a mastectomy on the contralateral side, one (1.5%) a lumpectomy on the ipsilateral side and three (4.5%) a lumpectomy on the contralateral side. There were 63 cases (94%) of unilateral tumor and four cases (6%) of bilateral breast cancer. Details on tumor location and neoadjuvant treatment can be found in (Table I).

Operative characteristics. The average breast reduction weight on the ipsilateral side was 248.5±236.4 g. Symmetry was addressed through simultaneous contralateral breast reduction in 56 patients (88.8%). The superomedial pedicle was the most employed approach, employed in 26 (36.6%) breasts, followed by the inferior pedicle used in 20 (28.1%) breasts, followed by the superior pedicle in 18 (25.4%) breasts, and other pedicles in seven (9.9%) breasts. When a contralateral breast reduction was performed, the same reduction technique was employed. The mean operative time was 187.5 min±75.7 min. Sentinel lymph node biopsy (SLNB) was performed intraoperatively before ORM in all but five patients, with two patients undergoing the procedure later. Axillary lymph node dissection (AD) was carried out in 14 (19.7%) cases due to SLNB positivity, with AD being performed simultaneously in 13 cases (18.3%) and at a distance in one (1.4%) case (Table II).

Oncological characteristics. Details on final pathological findings and American Joint Committee on Cancer (AJCC) TNM stages are presented in Table III. At our center, decisions on neoadjuvant and adjuvant treatment are discussed in multidisciplinary tumor boards. Following surgery, most patients (86%) underwent radiotherapy, after a median time of 60 days [interquartile range (IQR)=153 days]. Other adjuvant treatment modalities are described in Table III.

Postoperative outcomes. On the ipsilateral side, surgical complications were observed in 13 breasts (18.3%), compared to six breasts (10.7%) in the contralateral side (p=0.23). At the axillary site, one case of superficial infection and one seroma occurred. Hematoma occurred in four breasts (5.6%) and one breast (1.8%) on the ipsilateral breast and contralateral breast, respectively. Wound dehiscence of the breast occurred in four cases (5.6%) on the ipsilateral side and in four cases on the

Table III. *Operative characteristics*.

Operative characteristics	
Histological type, n (%)	n=71
DCIS	6 (8.5%)
Invasive ductal carcinoma	59 (83.1%)
Invasive lobular carcinoma	5 (7%)
Other	1 (1.4%)
pT stage, n (%)	n=71
Tis	5 (7.0%)
T1a	4 (5.6%)
T1b	9 (12.7%)
T1c	23 (32.4%)
T2	26 (36.6%)
T3	2 (2.8%)
Not reported	2 (2.8%)
Lymph node involvement, n (%)	n=71
N0	46 (64.8%)
N1a	11 (15.5%)
N1mi	6 (8.4%)
N2	2 (2.8%)
N2a	2 (2.8%)
N3	1 (1.4%)
N3a	1 (1.4%)
Not reported	2 (2.8%)
Tumor stage at intervention, n (%)	n=71
0	7 (9.9%)
IA	27 (38.0%)
IB	3 (4.2%)
IIA	19 (26.7%)
IIB	8 (11.3%)
IIIA	5 (7.0%)
IIIB	2 (2.8%)
Tumor grade, n (%)	n=71
1	2 (2.8%)
2	43 (60.6%)
3	26 (36.6%)
Receptor positivity, n (%)	n=71
ER/PR+	50 (70.4%)
HER2+	7 (9.9%)
ER/PR/HER2+	6 (8.5%)
ER-/PR-/HER2-	7 (9.9%)
Not reported	1 (1.4%)
Margins, n (%)	n=71
Positive	5 (7.0%)
Negative	66 (93.0%)
Adjuvant treatment, n (%)	n=67
Radiotherapy	58 (86.6%)
Chemotherapy	27 (40.3%)
Immunotherapy	14 (20.9%)
Endocrine therapy	52 (77.6%)
Time from start of radiotherapy, median (IQR) [days]	60 (153)

Table IV. *Postoperative outcomes*.

Operative characteristics	
Ipsilateral breast complications, n (%)	n=71
Hematoma	4 (5.6%)
Seroma	4 (5.6%)
Wound dehiscence	6 (8.4%)
Infection	1 (1.4%)
Skin necrosis	0 (0%)
Total breasts with ≥1 complication	13 (18.3%)
Total breasts with no complication	58 (81.7%)
Re-operation, n (%)	9 (12.7%)
Salvage breast surgery	5 (7.0%)
Margin expansion	1 (1.4%)
Completion mastectomy	4 (5.6%)
Hematoma evacuation	4 (5.6%)
Axillary complications, n (%)	
Seroma	1 (1.4%)
Infection	1 (1.4%)
Final breast conservation, n (%)	66 (93.0%)
Contralateral breast complications, n (%)	n=56
Hematoma	1 (1.8%)
Seroma	1 (1.8%)
Wound dehiscence	4 (7.1%)
Infection	0 (0%)
Skin necrosis	0 (0%)
Total breasts with ≥1 complication	6 (10.7%)
Total breasts with no complication	50 (89.3%)
Re-operation, n (%)	1 (1.8%)
Hematoma evacuation	1 (1.8%)

contralateral side (7.1%). There were four seromas (5.6%) and one seroma (1.8%) observed on the ipsilateral and contralateral breast, respectively. One patient (1.4%) developed an infection on the ipsilateral breast. Five patients (7.4%) required reoperation for hematoma evacuation, while other complications were successfully managed conservatively. There were no differences in the reoperation rate for surgical complications (p=0.38) between ipsilateral and contralateral breasts.

In terms of oncological outcomes of ORM, the resection margins were positive in five cases (7.0%), requiring a margin expansion in one case (1.4%) and a completion mastectomy in four cases (5.6%) – with three cases necessitating a skin-sparing mastectomy with implant-based reconstruction and one case undergoing a mastectomy followed by an immediate autologous breast reconstruction, using a deep inferior epigastric artery perforator (DIEP) flap.

Contralateral breast reduction in a second time was planned for seven (11.1%) patients. The median follow-up time in the plastic surgery clinic was 6.3 months (IQR=9.7) (Table IV).

Discussion

Reduction mammoplasty in the treatment of breast hypertrophy is a commonly performed breast reconstruction surgery, that is safe and is associated with very high patient satisfaction (12, 13). In breast cancer patients presenting with excess breast volume and ptosis, oncoplastic reduction mammoplasty, based

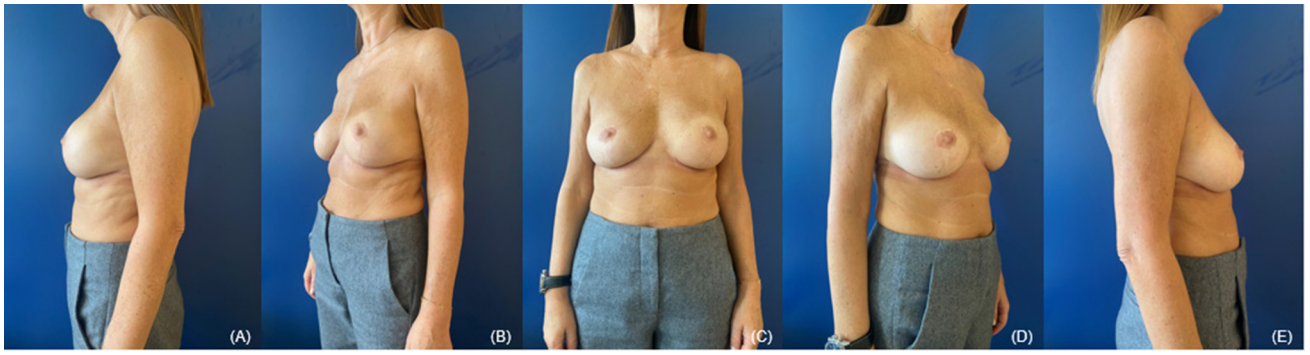

Figure 3. *Postoperative result - lateral (A, E), frontal (C) and semi-lateral (B, D) views at 12 months, following an oncoplastic reduction mammoplasty of the left breast and an immediate symmetrization of the contralateral breast, using an inferior pedicle technique on both sides. The weight of the resected tumor was 35 g and the reduction weight on the right side was 181 g.*

on reduction mammoplasty techniques lead to the achievement of wider excision margins (11). Moreover, immediate symmetrization of the contralateral breast can be performed during the same surgery, thus allowing the avoidance of pronounced asymmetry relative to the unaffected breast.

ORM techniques have been increasingly utilized in recent years, demonstrating good oncological outcomes and better aesthetic results compared to standard breast conserving surgery (6, 7, 10, 11, 14-17).

In the present study, the overall complication rate following ORM was 18.3%, with most postoperative complications managed conservatively, with no differences in overall complication rates between cancer-affected breasts and contralateral breasts. The reoperation rate due to surgical complications was low, with four patients (5.6%) requiring surgical evacuation of a hematoma on the ipsilateral side and one patient (1.8%) requiring evacuation of a hematoma on the contralateral side. This is similar to other retrospective studies on ORM and consistent with complication rates reported in recent meta-analyses (5, 7, 10, 11, 18, 19). Noteworthily, the proportion of active smokers in our study was high at 28.4%. A subgroup analysis focusing on patients presenting surgical complications showed that active smokers were at significantly higher risk of developing a surgical complication (p=0.03) compared to nonsmokers. We found no significant association between BMI or the pedicle technique and surgical complications in the subgroup analysis.

Interestingly, the majority patients had a bilateral breast reduction, with immediate symmetrization (88.8%), which did not translate into a significant increase of revision procedures, despite most patients receiving adjuvant radiotherapy.

The choice of pedicle did not impact the complication rates or oncological outcomes. While the type of pedicles have been extensively compared in standard breast reduction, there is a lack of such data in oncoplastic reduction mammoplasty (12, 13). This would be an interesting aspect that could be studies across ORM procedures, and further large studies needed to assess the safety and efficacy of the different types of pedicles in patients with breast cancer. The positive margin rate in our cohort was 7%, which is slightly below the 10% reported in recent meta-analysis on oncoplastic reduction mammoplasty (11). Moreover, a meta-analysis by Losken *et al*. reported a positive margin rate of 20.6% (619/3014) in patients who underwent standard breast conserving surgery and two earlier studies showed positive margin rates of 26% and 38%, respectively, in patients who had standard breast conserving surgery (7, 20-25). One factor potentially contributing to this rate is the non-standard practice of using frozen section examination at our center, which could help lower the positive margin rate, as it enables direct removal of remaining tumoral tissue. Indeed, a large retrospective cohort analysis by Boughey *et al*. showed that intraoperative frozen section procedure decreased the reoperation rate in patients undergoing breast conservative surgery (26).

In our retrospective study, one patient (1.4%) necessitated margin expansion surgery, while four patients (5.6%) underwent a completion mastectomy, with three undergoing a skin-sparing mastectomy followed by immediate implant-based reconstruction and one having a mastectomy and immediate DIEP flap autologous breast reconstruction due to positive surgical margins. The completion mastectomy rate in our cohort was in line with rates reported in other large series analyzing oncoplastic reduction mammoplasty outcomes, with rates ranging from 1 to 8% (7, 9, 24, 27, 28).

The median time to initiation of adjuvant radiation therapy was 60 days. Notably, there were no cases of delays in the initiation of treatment related to postoperative complications. This goes against a recent study from Fasola *et al*. that reported that ORM posed a risk of delaying radiotherapy by more than 8 weeks. However, the authors noted that such a delay did not result in local control issues (29).

During the follow-up, patients were generally very pleased with the aesthetic results and reported high satisfaction, with only few patients requiring touch-up surgeries. Although we did not use a standardized aesthetics satisfaction test, the cosmetic results were excellent (Figure 3). This observation is consistent with other large studies and studies comparing oncoplastic breast surgery to conservative techniques (17, 18, 30).

Our study is constrained by several limitations stemming from its retrospective design and small sample size. Furthermore, the relatively brief median follow-up period of six months might restrict our capacity to adequately identify late complications. Another limitation is the absence of patient-reported outcome measures to evaluate aesthetic outcomes.

Conclusion

This monocentric retrospective study provides a complete analysis of postoperative outcomes on a large cohort of patients undergoing ORM in the context of breast cancer and shows the technique was safe, with complication rates similar to rates observed following standard reduction mammoplasty. It also shows that ORM does not lead to delays in radiotherapy treatment. Active smokers were more at risk of developing postoperative complications in this study, while no differences in complications were observed across BMI subgroups. Moreover, patients report high satisfaction with aesthetic results.

Funding

None.

Conflicts of Interest

The Authors have no conflicts of interest to declare in relation to this study.

Authors' Contributions

Conceptualization, J.M. and C.M.O.; methodology, J.M. and C.M.O.; validation, G-T.L, S.G., D.F.K. and C.M.O.; formal analysis, J.M. and C.M.O; investigation, J.M., B.T., D.C.; data curation, J.M., B.T., D.C; writing—original draft preparation, J.M.; writing—review and editing, B.T.,G-T:L., S.G. and C.M.O.; supervision, D.F.K. and C.M.O. All Authors have read and agreed to the published version of the manuscript.

References

1 Veronesi U, Cascinelli N, Mariani L, Greco M, Saccozzi R, Luini A, Aguilar M, Marubini E: Twenty-year follow-up of a randomized study comparing breast-conserving surgery with radical mastectomy for early breast cancer. N Engl J Med 347(16): 1227-1232, 2002. DOI: 10.1056/NEJMoa020989

2 Fisher B, Anderson S, Bryant J, Margolese RG, Deutsch M, Fisher ER, Jeong JH, Wolmark N: Twenty-year follow-up of a randomized trial comparing total mastectomy, lumpectomy, and lumpectomy plus irradiation for the treatment of invasive breast cancer. N Engl J Med 347(16): 1233-1241, 2002. DOI: 10.1056/NEJMoa022152

3 Cochrane RA, Valasiadou P, Wilson ARM, Al-Ghazal SK, Macmillan RD: Cosmesis and satisfaction after breast-conserving surgery correlates with the percentage of breast volume excised. Br J Surg 90(12): 1505-1509, 2003. DOI: 10.1002/bjs.4344

4 Waljee JF, Hu ES, Ubel PA, Smith DM, Newman LA, Alderman AK: Effect of esthetic outcome after breast-conserving surgery on psychosocial functioning and quality of life. J Clin Oncol 26(20): 3331-3337, 2008. DOI: 10.1200/JCO.2007.13.1375

5 Kosasih S, Tayeh S, Mokbel K, Kasem A: Is oncoplastic breast conserving surgery oncologically safe? A meta-analysis of 18,103 patients. Am J Surg 220(2): 385-392, 2020. DOI: 10.1016/j.amjsurg.2019.12.019

6 Campbell EJ, Romics L: Oncological safety and cosmetic outcomes in oncoplastic breast conservation surgery, a review of the best level of evidence literature. Breast Cancer (Dove Med Press) 9: 521-530, 2017. DOI: 10.2147/BCTT.S113742

7 Losken A, Dugal CS, Styblo TM, Carlson GW: A meta-analysis comparing breast conservation therapy alone to the oncoplastic technique. Ann Plast Surg 72(2): 145-149, 2014. DOI: 10.1097/SAP.0b013e3182605598

8 Chatterjee A, Gass J, Patel K, Holmes D, Kopkash K, Peiris L, Peled A, Ryan J, El-Tamer M, Reiland J: A consensus definition and classification system of oncoplastic surgery developed by the American Society of Breast Surgeons. Ann Surg Oncol 26(11): 3436-3444, 2019. DOI: 10.1245/s10434-019-07345-4

9 Benedict KC, Brown MI, Berry HA, Berry SM, O'Brien RC, Davis JM: Oncoplastic breast reduction: a systematic review of postoperative complications. Plast Reconstr Surg Glob Open 11(10): e5355, 2023. DOI: 10.1097/GOX.0000000000005355

10 Piper ML, Esserman LJ, Sbitany H, Peled AW: Outcomes following oncoplastic reduction mammoplasty. Ann Plast Surg 76 Suppl 76(Supplement 3): S222-S226, 2016. DOI: 10.1097/SAP.0000000000000720

11 Tekdogan B, Martineau J, Scampa M, Kalbermatten DF, Oranges CM: Oncoplastic reduction mammoplasty: Systematic review and proportional meta-analysis of surgical outcomes. J Plast Reconstr Aesthetic Surg 89: 86-96, 2024. DOI: 10.1016/j.bjps.2023.11.052

12 Watfa W, Martineau J, Giordano S, Sapino G, Bramhall RJ, di Summa PG: Long-term evaluation of Nipple–Areolar complex changes in inferior *versus* superomedial pedicle reduction mammoplasty: A comparative study. J Plast Reconstr Aesthetic Surg JPRAS 75(3): 1179-1186, 2022. DOI: 10.1016/j.bjps.2021.11.007

13 Sapino G, Haselbach D, Watfa W, Baudoin J, Martineau J, Guillier D, di Summa PG: Evaluation of long-term breast shape in inferior *versus* superomedial pedicle reduction mammoplasty: a comparative study. Gland Surg 10(3): 1018-1028, 2021. DOI: 10.21037/gs-20-440

14 Santos G, Urban C, Edelweiss MI, Zucca-Matthes G, de Oliveira VM, Arana GH, Iera M, Rietjens M, De Lima RS, Spautz C, Kuroda F, Anselmi K, Capp E: Long-term comparison of aesthetical outcomes after oncoplastic surgery and lumpectomy in breast cancer patients. Ann Surg Oncol 22(8): 2500-2508, 2015. DOI: 10.1245/s10434-014-4301-6

15 Mansell J, Weiler-Mithoff E, Stallard S, Doughty J, Mallon E, Romics L: Oncoplastic breast conservation surgery is oncologically safe when compared to wide local excision and mastectomy. Breast Edinb Scotl 32: 179-185, 2017. DOI: 10.1016/j.breast.2017.02.006

16 Losken A, Pinell-White X, Hart AM, Freitas AM, Carlson GW, Styblo TM: The oncoplastic reduction approach to breast conservation therapy: benefits for margin control. Aesthet Surg J 34(8): 1185-1191, 2014. DOI: 10.1177/1090820X14545618

17 Stein MJ, Karir A, Arnaout A, Roberts A, Cordeiro E, Zhang T, Zhang J: Quality-of-life and surgical outcomes for breast cancer patients treated with therapeutic reduction mammoplasty *versus* mastectomy with immediate reconstruction. Ann Surg Oncol 27(11): 4502-4512, 2020. DOI: 10.1245/s10434-020-08574-8

18 Gulis K, Rydén L, Bendahl PO, Svensjö T: Cosmetic outcomes and symmetry comparison in patients undergoing bilateral therapeutic mammoplasty for breast cancer. World J Surg 45(5): 1433-1441, 2021. DOI: 10.1007/s00268-020-05941-0

19 Di Micco R, O'Connell RL, Barry PA, Roche N, MacNeill FA, Rusby JE: Bilateral mammoplasty for cancer: Surgical, oncological and patient-reported outcomes. Eur J Surg Oncol J Eur Soc Surg Oncol Br Assoc Surg Oncol 43(1): 68-75, 2017. DOI: 10.1016/j.ejso.2016.08.013

20 Lovrics PJ, Cornacchi SD, Farrokhyar F, Garnett A, Chen V, Franic S, Simunovic M: Technical factors, surgeon case volume and positive margin rates after breast conservation surgery for early-stage breast cancer. Can J Surg 53(5): 305-312, 2010.

21 Atkins J, Al Mushawah F, Appleton CM, Cyr AE, Gillanders WE, Aft RL, Eberlein TJ, Gao F, Margenthaler JA: Positive margin rates following breast-conserving surgery for stage I-III breast cancer: palpable *versus* nonpalpable tumors. J Surg Res 177(1): 109-115, 2012. DOI: 10.1016/j.jss.2012.03.045

22 Mohamedahmed AYY, Zaman S, Zafar S, Laroiya I, Iqbal J, Tan MLH, Shetty G: Comparison of surgical and oncological outcomes between oncoplastic breast-conserving surgery *versus* conventional breast-conserving surgery for treatment of breast cancer: A systematic review and meta-analysis of 31 studies. Surgical Oncology 42: 101779, 2022. DOI: 10.1016/j.suronc.2022.101779

23 De La Cruz L, Blankenship SA, Chatterjee A, Geha R, Nocera N, Czerniecki BJ, Tchou J, Fisher CS: Outcomes after oncoplastic breast-conserving surgery in breast cancer patients: a systematic literature review. Ann Surg Oncol 23(10): 3247-3258, 2016. DOI: 10.1245/s10434-016-5313-1

24 Heeg E, Jensen MB, Hölmich LR, Bodilsen A, Tollenaar RAEM, Laenkholm AV, Offersen BV, Ejlertsen B, Mureau MAM, Christiansen PM: Rates of re-excision and conversion to mastectomy after breast-conserving surgery with or without oncoplastic surgery: a nationwide population-based study. Br J Surg 107(13): 1762-1772, 2020. DOI: 10.1002/bjs.11838

25 Niinikoski L, Leidenius MH, Vaara P, Voynov A, Heikkilä P, Mattson J, Meretoja TJ: Resection margins and local recurrences in breast cancer: Comparison between conventional and oncoplastic breast conserving surgery. Eur J Surg Oncol 45(6): 976-982, 2019. DOI: 10.1016/j.ejso.2019.02.010

26 Boughey JC, Hieken TJ, Jakub JW, Degnim AC, Grant CS, Farley DR, Thomsen KM, Osborn JB, Keeney GL, Habermann EB: Impact of analysis of frozen-section margin on reoperation rates in women undergoing lumpectomy for breast cancer: Evaluation of the National Surgical Quality Improvement Program data. Surgery 156(1): 190-197, 2014. DOI: 10.1016/j.surg.2014.03.025

27 Pawlak N, Karamchandani M, Wareham C, Gaffney K, Zaccardelli A, Nardello S, Persing S, Chatterjee A, Homsy C: Comparing oncoplastic breast reduction with immediate symmetry surgery to standard breast reduction surgery: Are postoperative complications worse? J Surg Oncol 126(6): 956-961, 2022. DOI: 10.1002/jso.27009

28 Morrison KA, Frey JD, Karp N, Choi M: Revisiting reduction mammaplasty: Complications of oncoplastic and symptomatic macromastia reductions. Plast Reconstr Surg 151(2): 267-276, 2023. DOI: 10.1097/PRS.0000000000009828

29 Fasola CE, Sharp HJ, Clavin NW, Sha W, Schepel CR, Trufan SJ, Graham E, Hecksher A, White RL Jr, Hadzikadic-Gusic L: Effect of delayed oncoplastic reduction mammoplasty on radiation treatment delay following breast-conserving surgery for breast cancer. Ann Surg Oncol 30(13): 8362-8370, 2023. DOI: 10.1245/s10434-023-14177-w

30 Koppiker CB, Noor AU, Dixit S, Busheri L, Sharan G, Dhar U, Allampati HK, Nare S: Extreme oncoplastic surgery for multifocal/multicentric and locally advanced breast cancer. Int J Breast Cancer 2019: 4262589, 2019. DOI: 10.1155/2019/4262589

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